



Dual-Core Intel® Xeon® Processor-based Platforms

A Reliable Foundation for Flexible
and Responsive Business Services



Build Success into Your Business

Your IT and business challenges are relentless. So is our passion and drive to deliver the right technology solutions to you. Whether your focus is on reliability, cost reduction, or a more responsive, flexible infrastructure, Intel has a platform solution that can meet your needs. With Intel's advanced technologies built into your infrastructure, you build success into your IT services and your business.

Intel continues to build more capabilities into platforms so you can do much more. We combine effective technologies, software services, and industry alliances, so you can optimize your servers to deliver the right business services more efficiently and at low cost. With nearly 40 million Intel® processor-based servers shipped since 1996, and a 20-year track record of delivering enterprise-class performance, you know you can count on Intel to deliver superior quality and reliability.

Our next step helps you move, and stay, ahead

Intel's latest 64-bit dual-processor (DP) platforms based on the new Dual-Core Intel® Xeon® processor 5000¹ series help your data center be more available and more responsive to changing business needs, while improving operational efficiency. Innovation throughout the server and enabled across the industry provides IT departments with advanced platforms that deliver exciting new capabilities for business.

The new Dual-Core Intel Xeon processor 5000 series provides faster processing capabilities and better power efficiency, addressing both system response and power consumption. Servers based on the new Dual-Core Intel Xeon processor 5000 series help improve compute density and utilization and provide stability for long-range data center planning and optimization. Embedded capabilities, such as enhanced I/O and better security, accelerate data access and improve service continuity.

Dual-core is just the beginning. At Intel, we recognize that business requirements mean more than creating processors that deliver greater performance. That's why we will continue to provide server solutions that optimize performance and power efficiency, and add new technologies that help IT infrastructures remain adaptable to changing business needs.



Dual-Core Intel® Xeon® processor-based DP platforms offer the performance and flexibility to help IT adapt and respond faster to new business opportunities.



Improve Efficiency and Service Uptime

New Dual-Core Intel Xeon processor-based DP platforms better help you meet your IT and business challenges head-on with dependable, responsive platforms. They allow you to continue to deliver new services, manage systems more efficiently, and secure your data and infrastructure more effectively.

Do more with fewer systems

The added performance and reliability of new Dual-Core Intel Xeon processor-based servers combined with proven software-based virtualization let you dynamically pool hardware resources to boost utilization and build out critically needed business services. Now, you can achieve greater flexibility, plus run 64-bit operating systems and applications using Intel® Virtualization Technology². Integrated into Dual-Core Intel Xeon processor 5000 series, and supported by the industry's leading virtualization software providers, Intel Virtualization Technology enhances software-based virtual environments with hardware assistance.

Optimize data center density

With up to twice the performance and up to 3 times higher performance/watt over the previous-generation processors, we've taken a comprehensive approach to power/thermal challenges that establishes a new level of thermal efficiency and stability for data center planning and optimization – without sacrificing the performance customers expect from Intel servers³. Our power and thermal management features help you improve space and asset utilization, so you can deliver more services in the same amount of space, or even less.

Improve business continuity and compliance

Our new server platforms build in rock-solid reliability and enhanced security to help improve the integrity of business data and services. Processor chipset enhancements, plus Fully Buffered DIMM (FBDIMM) and PCI Express* (PCIe*) reliability features, help create a server you can rely on. You'd expect nothing less given Intel's proven track record for delivering reliable systems.

Innovative Technologies and a Dependable, Balanced Platform Help Businesses be More Efficient and Responsive

Flexible platforms for an agile business

Dual-Core Intel Xeon processor-based DP platforms enable flexibility and adaptability, helping your infrastructure scale with changing business needs. Performance enhancements, coupled with hardware-assisted virtualization, Intel embedded technologies, and Intel software optimization tools help improve business services and user productivity.

- Dual-core, 64-bit computing for intensive workloads and large datasets.
- New dual independent buses between processors and chipset at up to 1333³ MHz enhance platform throughput.
- Up to 3 times the peak system bus bandwidth (21 GB/s @ 1333 MHz)⁴
- Broad choice of performance-optimized processors at 130 watts, plus a rack-optimized version at 95 watts, provides options for data center optimization to meet your business demands.
- FBDIMM technology provides greater system throughput and reliability.
- Up to 64 GB of memory capacity enables processing of larger data sets, keeps more critical data closer to the processing cores, and enables enhanced memory-based reliability and availability capabilities.
- Intel® I/O Acceleration Technology⁵ (Intel® I/OAT) delivers up to twice the I/O throughput and cuts CPU overhead by up to 40 percent for better application response, compared to 64-bit Intel® Xeon® processor-based servers and Intel® 7520 chipset.

Take the next leap in server memory performance and capacity with FBDIMM technology

New FBDIMM technology is widely recognized as the next leap in memory technology, with broad support by industry memory manufacturers and original equipment manufacturers (OEMs). FBDIMM's ability to simultaneously boost memory throughput, bandwidth, capacity, and reliability offers new potential and flexibility to IT. FBDIMM technology delivers 4 times the memory capacity (up to 64 GB) and 3 times peak bandwidth (up to 21 GB/sec with 1333 MHz system bus⁶) of previous-generation Intel E7520 chipset platforms with DDR2-400 memory. FBDIMM removes the memory access bottlenecks with higher data rates and lower latency and breaks the memory limitation barrier typically found in today's servers. Dual-Core Intel Xeon processor 5000 series-based DP platforms with FBDIMMs boost system responsiveness for data-intensive applications and business-critical services.

FBDIMM uses high-speed serial links – instead of the existing technology's parallel stub buses – that operate at much higher speeds for faster response, enable greater memory capacity, and improve reliability, availability, and data integrity. An Advanced Memory Buffer (AMB) on each DIMM communicates with the memory controller and industry-standard DDR2 DRAMs and provides advanced reliability features for higher availability. Using standard DRAMs, FBDIMM technology is a natural evolution of memory technology.

Server platforms based on the latest Dual-Core Intel Xeon processors with FBDIMMs are optimized for fast data access and processing. Coupled with the new Intel I/OAT, overall system performance and response is further improved. The integration of both FBDIMM technology with Intel I/OAT in one platform helps create a balanced, high-performance platform for even the most demanding IT services and business-critical applications.

Take advantage of energy-efficient performance to grow business services using your existing power and cooling capacity

Today's businesses demand more computing capacity and performance, but data centers are limited by their existing physical infrastructures and IT departments by their budgets. Dual-Core Intel Xeon processor-based server platforms, with an innovative energy-efficient microarchitecture, increase your computing capacity, without added power density. You can put more compute power into your existing power and cooling envelopes, expanding new services with energy-efficient platforms and reducing pressure to expand or build new facilities.

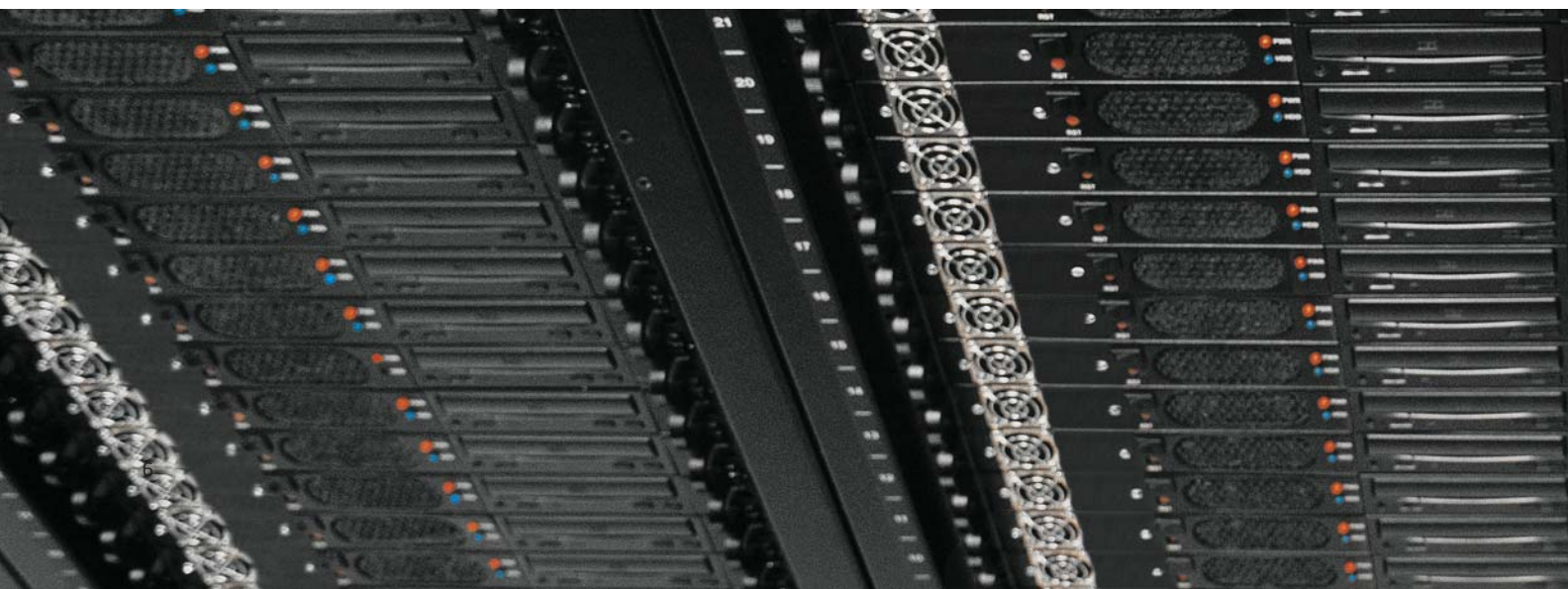
New Dual-Core Intel Xeon processor 5000 series offers low-power options that enable you to select the right platform for your business. You can easily match your computing needs with your facility's power and cooling capacities, from platforms based on ultra-low-power processors for high-density blade servers to rack-optimized processors for your most intense computing demands.

Combining enhanced server virtualization with Intel Virtualization Technology, Intel® Software tools, and new energy-efficient Dual-Core Intel Xeon processor-based server platforms enables you to truly optimize your data center for computing capacity, performance, and power and cooling demands.

Embedded technologies improve performance, manageability, reliability, and security

Enhance virtual environments with Intel® Virtualization Technology

Intel has worked with the leading operating system and virtualization software companies, such as VMWare, Microsoft, and XenSource, to enhance software-based virtual environments with hardware-assistance from Intel Virtualization Technology. This new technology expands support for operating systems, including 64-bit operating systems and software, to help data centers be more responsive with a more scalable, flexible IT infrastructure. Intel's hardware-assistance is built into the processor and enabled by operating systems and virtualization software designed to support Intel Virtualization Technology.



Enhance performance for data-intensive applications with PCI Express*

PCI Express (PCIe) has become the mainstream I/O technology for balanced platforms. It provides the necessary bandwidth and lower latency to keep up with the capabilities of dual-core computing. A PCIe x1 link delivers a bi-directional peak bandwidth of 500 MB/s, while x4 and x8 links provide 2 GB/s and 4 GB/s, respectively. The lower latency and the increased bandwidth help deliver the throughput required to fully utilize the processor's improved capabilities.

Boost overall system performance with Intel® I/O Acceleration Technology

Intel I/O Acceleration Technology improves network responsiveness through more efficient network data movement and reduced system overhead. Intel multiport network adapters with Intel I/O Acceleration Technology provide high-performance I/O for server consolidation and virtualization. Stateless network acceleration seamlessly scales across multiple ports and virtual machines. Intel I/OAT provides safe and flexible network acceleration through tight integration into popular operating systems and virtualization software, avoiding the support risks of third-party network stacks and preserving existing network requirements such as teaming and failover.

Compared to standard Gigabit Ethernet, Intel I/O Acceleration can deliver up to twice the data movement and reduce CPU overhead by up to 40 percent for faster application response, compared to 64-bit Intel Xeon processor-based servers and Intel 7520 chipset. Intel I/O Acceleration Technology is a platform innovation that includes the following:

- Processor acceleration: protocol stacks optimized for Intel® architecture improves data access.
- Intel® 5000 Series chipsets enhancements: data copying offloaded from the CPU to the chipset moves data faster.
- Intel® 82563EB Dual Port adapter and Intel® 82564EB Single Port adapter: parallel processing of data and commands supports better data flow to and from the network.
- Software-enabled: BIOS and operating systems⁵ unlock the capabilities of Intel I/O Acceleration Technology.

For more information, please visit www.intel.com/go/ioat.

Manage more efficiently and reduce costs with Intel® Active Server Manager

Intel® Active Server Manager⁷ provides advanced tools to efficiently manage servers – regardless of power or system state – helping you reduce management and maintenance costs and refocus your staff's efforts on more critical tasks. Even with a crashed hard drive or locked operating system, your technical staff can access the platform from a remote console for diagnostics, recovery, and inventory control using Intel Active Server Manager's integrated hardware, firmware, and out-of-band communications.

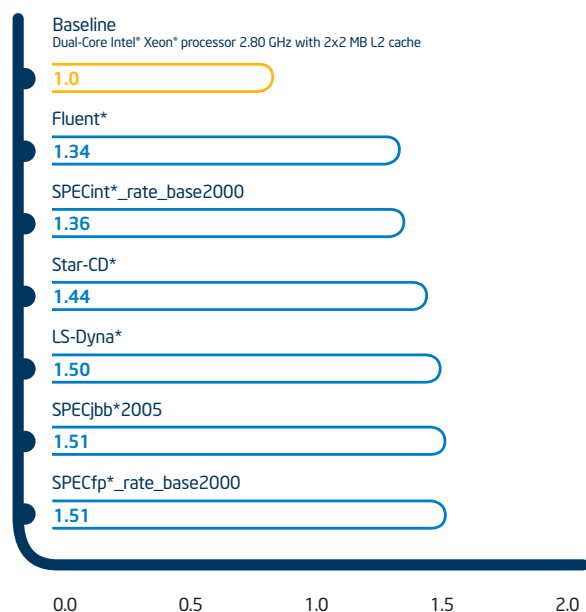


Proven virtual environments can now support 64-bit operating systems and applications alongside 32-bit virtual environments with Intel® Virtualization Technology.

Dual-Core Intel® Xeon® Processor-based Platforms Overview

Platform Feature	User Benefit
Dual-Core Intel® Xeon® processor 5000 ¹ series	<ul style="list-style-type: none"> ▪ 64-bit, dual-core computing ▪ Up to twice the performance versus previous-generation single-core processors ▪ Up to 3 times the performance/watt³
Intel® Virtualization Technology ²	<ul style="list-style-type: none"> ▪ Enables 64-bit operating systems and software to run over today's popular virtualization software ▪ Developed with virtualization software providers to enable greater functionality, robustness, and compatibility compared to non-hardware-assisted virtual environments
Hyper-Threading Technology ⁴	<ul style="list-style-type: none"> ▪ Allows each core to function as two logical processors for better compute throughput when used with threaded applications. Improves processor utilization and system responsiveness for better user experience compared to previous generations
Dual Independent buses (1066 MHz and 1333 ³ MHz)	<ul style="list-style-type: none"> ▪ Up to 17 GB/s with 1066 MHz and up to 21 GB/s with 1333 MHz
Intel® Extended Memory 64 Technology ³ (Intel® EM64T)	<ul style="list-style-type: none"> ▪ Enables extended memory addressability for server applications
Demand-Based Switching (DBS) with Enhanced Intel SpeedStep® technology	<ul style="list-style-type: none"> ▪ Enables platform and software power management features to help lower average power consumption while maintaining application performance and helping to reduce noise levels from fans
Fully Buffered DIMM technology	<ul style="list-style-type: none"> ▪ Provides up to 3 times the increase in memory bandwidth over previous memory technology ▪ 4 times the memory capacity up to 64 GB ▪ Enhanced reliability, availability, and serviceability features
Intel® Power Tools ⁵	<ul style="list-style-type: none"> ▪ Helps IT personnel optimize data center utilization and power consumption with more accurate estimation and measurement of power demand by platforms
Intel® Active Server Manager ⁷	<ul style="list-style-type: none"> ▪ Enables more efficient management of servers
Intel® I/O Acceleration Technology ⁶ (Intel® I/OAT)	<ul style="list-style-type: none"> ▪ Increases data movement by as much as 30 percent over previous-generation systems
PCI Express* serial I/O	<ul style="list-style-type: none"> ▪ Industry-standard serial I/O capable of up to 4 GB/s peak bandwidth with x8 link ▪ Improved RAS features compared to PCI-X* ▪ Lower latency compared to PCI-X for improved I/O performance ▪ Software compatible with PCI-X to simplify parallel-to-serial transition
Enhanced reliability and manageability	<ul style="list-style-type: none"> ▪ Many memory controller features, together with PCI Express RAS features combine to help improve platform reliability vs. previous-generation platforms ▪ New features include Error Correcting Code (ECC) system bus, new memory mirroring and I/O hot-plug ▪ The Intel® 5000V/P chipsets include an SMBus port for remote management operation and support for a variety of third-party BMC (base management controller) and BIOS solutions

Dual-Core Intel® Xeon® Processor 5080 Series-based Server Platform Performance



SPECint*_rate_base2000: This benchmark evaluates the integer throughput of the measured system. Comparison based on published result.

Baseline Platform Configuration: IBM eServer xSeries* 346 Server platform with two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2 MB L2 Cache 4 GB DDR2, Microsoft Windows Server* 2003, standard Edition, Intel C/C++ Compiler 9.0. Referenced as published at <http://www.spec.org/cpu2000/results/res2005q4/cpu2000-20051006-04904.html>

New Platform Configuration: Fujitsu Siemens Computers PRIMERGY* RX300 S3 server platform with two Intel® Xeon® processors 5080, 16 GB (8x2 GB) FBDIMM memory, Microsoft Windows Server* 2003, Intel C/C++ Compiler 9.0. Submitted to www.spec.org as of March 6, 2006.

SPECfp*_rate_base2000: This benchmark evaluates the integer throughput of the measured system. Comparison based on published result.

Baseline Platform Configuration: FSC PRIMERGY* RX300 S2 Server platform with Two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2 MB L2 Cache 800 MHz system bus, 4 GB DDR2, 64-Bit Red Hat Enterprise Linux* AS release 4 update 1 Kernel 2.6.9-11.ELsmp on an x86_64 Intel C++ and Fortran Compiler 9.0 for Intel® EM64T Build 20050914 (for 64-bit applications). Referenced as published at <http://www.spec.org/cpu2000/results/res2005q4/cpu2000-20051004-04899.html>

New Platform Configuration: Fujitsu Siemens Computers PRIMERGY* RX300 S3 server platform with two Intel® Xeon® processors 5080, 16 GB (8x2 GB) FBDIMM memory, Microsoft Windows Server* 2003, Intel C/C++ Compiler 9.0. Submitted to www.spec.org as of March 6, 2006.

SPECjbb*2005: This workload evaluates the performance of Server-side Java Application. Performance measured in Business Operations Per Second. (Bops). Comparison based on published result.

Baseline Platform Configuration: Fujitsu Siemens Computers PRIMERGY* TX300 S2 server platform: Two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2 MB L2 cache 800 MHz system bus, 4 GB DDR2, Microsoft Windows Server* 2003, Java HotSpot* Server VM (build 1.5.0_06-b05). Referenced as published Results at <http://www.spec.org/jbb2005/results/res2005q4/jbb2005-20051206-00040.html>

New Platform Configuration: Fujitsu Siemens Computers PRIMERGY* TX300 S3 server platform with two Intel® Xeon® processors 5080, 16 GB (8x2 GB) FBDIMM memory, Microsoft Windows Server* 2003, BEA JRockit* 5.0 P26.0.0 (build P26.0.0-29-57671-1.5.0_06-20060218-2127-win-x86_64) Referenced as published at <http://www.spec.org/jbb2005/results/res2006q1/jbb2005-20060228-00083.html>

Fluent*: Version 6.2, geomean of 8 workloads. This HPC workload evaluates the performance of a Computational Fluid dynamics application. Performance measured in jobs/day. Intel internal measurement (Feb 2006).

Star-CD*: Version 3.22 engine workload. This HPC workload evaluates the performance of a Computational Fluid dynamics application. Performance measured in jobs/day. Intel internal measurement (Feb 2006).

LS-Dyna*: Version mpp970.5434a. 3 cars workload. This HPC workload evaluates the performance of a Car Crash Simulation application. Performance measured in jobs/day. Intel internal measurement (Feb 2006).

Same platform configuration for the above three workloads.

Baseline Platform Configuration: Intel® Server Pre-Production System with two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2 MB L2 Cache, Intel® E7520 Chipset, 800 MHz FSB; 8 GB (8x1 GB) DDR2-400 memory (8x1 GB), OS – Red Hat Enterprise Linux* AS release 4 (Nahant Update 1) Linux version 2.6.9-11.EL, Intel® EM64T.

New Platform Configuration: Intel® Server Pre-Production System with two Intel® Xeon® Dual-Core processors 5080, 8GB (8x1 GB) FBDIMMs; Hyper Threading OFF; Red Hat Enterprise Linux* AS release 4 2.6.9-5 EL x86_64 GNU/Linux Workload.

Disclaimers:

Relative performance for each benchmark is calculated by taking the actual benchmark result for the first platform tested and assigning it a value of 1.0 as a baseline. Relative performance for the remaining platforms tested was calculated by dividing the actual benchmark result for the baseline platform into each of the specific benchmark results of each of the other platforms and assigning them a relative performance number that correlates with the performance improvements reported.

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, reference http://www.intel.com/performance/resources/benchmark_limitations.htm or call (U.S.) 1-800-628-8686 or 1-916-356-3104.

Improve Service Uptime with Superior Reliability and Availability

Dual-Core Intel Xeon processor-based platforms with FBDIMM technology take reliability and availability to a new level.

Intel® 5000 Series chipsets RAS features

Enhanced reliability is integrated in the Intel 5000 Series chipsets, offering a high degree of memory error detection and correction, data protection, and serviceability.

Memory mirroring — Gives the option to duplicate system memory, protecting against uncorrectable errors or DRAM failure. Memory mirroring allows continued operation and data availability.

Memory sparing — Allows you to reserve spare memory capacity that can be used if current memory fails.

X8 Single Device Data Correction (X8 SDDC) — Allows you to fix the failure of an entire DRAM device on-the-fly by removing a single DRAM from the memory map and recovering its data into a new device.

Error Correcting Code (ECC) — The system detects single-bit and double-bit errors and automatically corrects single-bit errors on internal data paths. Plus, CRC and error correction on address, command, and data paths help boost system reliability and availability.

Hot-plug I/O — Add I/O after installation without service interruption.

FBDIMM technology RAS features

Incorporating a new Advanced Memory Buffer between the chipset and memory, FBDIMM technology adds new RAS features that make the platform even more robust, helping companies improve service uptime.

Fault or Function	Action by FBDIMM
Integrity check on data	▪ ECC, SDDC, and CRC
Integrity check on address and control	▪ CRC
Upon an uncorrectable error on a transaction	▪ Retry upon error, then log and continue if no error upon retry; escalate to OS only if hard error ▪ Without FBDIMM, this kind of error simply shuts down the system
Pass-through for AMB (DIMM) fault tolerance	▪ Same if error on DRAM or AMB core; less if whole AMB chip fails

PCI Express RAS enhances I/O availability

PCIe is rich in RAS capabilities critical to maintaining system uptime, including the following:

- Built-in clocking for Data Integrity Checking.
- Advanced error logging and reporting through IPMI.
- Hot-plug capability simplifies replacement of failed devices and helps reduce system downtime, while allowing mix and match of peripherals and systems or I/O chassis from different vendors.
- A high-performance, cost-effective RAID can be implemented on the server board using the Intel® IOP333 I/O processor, designed to connect directly to the chipset's memory controller via PCI Express.

For more information on Dual-Core Intel® Xeon® processor-based DP server platforms, please go to www.intel.com/server





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¹ Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See http://www.intel.com/products/processor_number for details.

² Intel® Virtualization Technology requires a computer system with a processor, chipset, BIOS, virtual machine monitor (VMM) and applications enabled for virtualization technology. Functionality, performance or other virtualization technology benefits will vary depending on hardware and software configurations. Virtualization technology-enabled BIOS and VMM applications are currently in development.

³ 5100 series processors with 1333 MHz bus available in 2nd half of 2006.

⁴ Performance comparison to Intel® Xeon® processor platforms with Intel® E7520 Chipset and DDR2-400 memory.

⁵ Microsoft will support Intel® I/OAT in future Microsoft Windows Server® releases.

⁶ Intel® Power Tools functionality requires support by the platform manufacturer. Check with your supplier to see if these features are available in your system.

⁷ Intel® Active Server Manager requires the computer to have additional hardware and software, connection with a power source, and a network connection. Check with your PC manufacturer for details.

⁸ 64-bit Intel® Xeon® processors with Intel® EM64T requires a computer system with a processor, chipset, BIOS, OS, device drivers and applications enabled for Intel EM64T. Processor will not operate (including 32-bit operation) without an Intel EM64T-enabled BIOS. Performance will vary depending on your hardware and software configurations. Intel EM64T-enabled OS, BIOS, device drivers and applications may not be available. Check with your vendor for more information.

⁹ Hyper-Threading Technology requires a computer system with an Intel® Xeon® processor supporting Hyper-Threading Technology and an HT Technology-enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. See <http://www.intel.com/info/hyperthreading/> for more information including details on which processors support HT Technology.

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